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ONTARIO WATER RESOURCES COMMISSION

ANNUAL REPORT 1965

# **BURLINGTON**

***Elizabeth Gardens***

***water pollution  
control plant***

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1965  
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DIVISION OF PLANT OPERATIONS

Ontario Water Resources Commission

**TD**  
**367**  
**.A56**  
**B875**  
**1965**

Burlington Elizabeth Gardens :  
water pollution control plant.

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ONTARIO WATER RESOURCES COMMISSION  
OFFICE OF THE GENERAL MANAGER

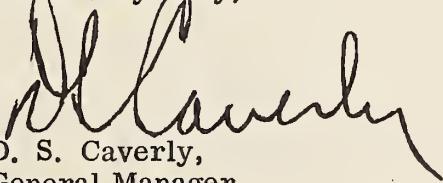
Members of the Burlington Elizabeth Gardens Local Advisory Committee  
Town of Burlington.

Gentlemen:

I am pleased to provide you with the 1965 Annual Report for the Burlington Elizabeth Gardens Water Pollution Control Plant, OWRC Project No.58-S-28.

We appreciate the co-operation you have extended to our Operations staff throughout the year, and trust that continuation of this close association will ensure even greater progress in the sphere of water pollution control.

Yours very truly,

  
D. S. Caverly,  
General Manager.



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ONTARIO WATER RESOURCES COMMISSION

801 BAY STREET

TORONTO 5

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CHAIRMAN

J. H. H. ROOT, M.P.P.  
VICE-CHAIRMAN

D. S. CAVERLY  
GENERAL MANAGER

W. S. MACDONNELL  
COMMISSION SECRETARY

General Manager,  
Ontario Water Resources Commission.

Dear Sir:

I am pleased to provide you with the 1965 Annual Report on the operation of the Burlington Elizabeth Gardens Water Pollution Control Plant, OWRC Project No. 58-S-28.

The report presents design data, outlines operating problems encountered during the year and summarizes in graphs, charts and tables all significant flow and cost data.

Yours very truly,

A handwritten signature in cursive script, appearing to read "B.C. Palmer".

B. C. Palmer, P. Eng.,  
Director,  
Division of Plant Operations.



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## **FOREWORD**

This report provides useful information on the operating efficiency of this project during 1965. It is intended to act as a guide in gauging plant performance. To implement that aim, it includes detailed statistical and cost data, a description of the project and a summary of its operation during the year.

Of particular interest will be the cost data, which show the total cost to the municipality and the areas of major expenditure.

The Regional Operations Engineer is primarily responsible for the preparation of the report, and has compiled and arranged the material. He will be pleased to answer any questions regarding it. Other groups, however, were involved in the production, and these include the statistics section, the Drafting Section of the Division of Sanitary Engineering and the Division of Finance.

B. C. Palmer, P. Eng.,  
Director,  
Division of Plant Operations.

**BURLINGTON**  
*Elizabeth Gardens*  
**water pollution control plant**  
operated for  
THE TOWN OF BURLINGTON  
by the  
ONTARIO WATER RESOURCES COMMISSION

---

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VICE-CHAIRMAN: J. H. H. Root, M.P.P.

COMMISSIONERS

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D. A. Moodie	L. E. Venchiarutti

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GENERAL MANAGER: D. S. Caverly

ASSISTANT GENERAL MANAGERS

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F. A. Voege	A. K. Watt

COMMISSION SECRETARY

W. S. MacDonnell

DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director:	C. W. Perry
Regional Supervisor:	D. A. McTavish
Operations Engineer:	B. W. Hansler

801 Bay Street      Toronto 5

# '65 REVIEW

Burlington Elizabeth Gardens WPCP treated a total of 299.865 million gallons of sewage during the year, at an operating cost of \$21,966.58. The operating cost per million gallons and the cost per pound of BOD removed were \$73.25 and \$0.06 respectively.

The average daily flow during the year was 0.822 million gallons. The design flow of 0.75 million gallons per day was exceeded 48 percent of the time. Substantial increases in flow are received at the plant during rain fall periods. Flows in excess of 1.2 million gallons per day were given only primary treatment and chlorinated before discharge to Lake Ontario. Flows in excess of 1.2 million gallons per day are beyond the hydraulic capabilities of the final clarifier.

The average raw sewage BOD and suspended solids concentrations during the year were 134 ppm and 144 ppm respectively. The average effluent BOD and suspended solids concentrations were 13 ppm and 9 ppm respectively. On an average the BOD and suspended solids reductions were 90.0 percent and 93.5 percent respectively.

## **GLOSSARY**

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

# **H**ISTORY

## **1958 - 1965**

### INCEPTION

In April 1958, the Town of Burlington and the Ontario Water Resources Commission initiated plans for the expansion of an existing primary treatment plant into a modern water pollution control plant.

The firm of Proctor and Redfern, Toronto Ontario, Consulting Engineers, was engaged to prepare plans and specifications for the project.

### APPROVAL

In December 1958, the Town signed an agreement with the Ontario Water Resources Commission to finance, construct and operate the expanded plant.

### CONSTRUCTION

Halco Construction Company and Schwenger Construction Limited, began construction in June 1959, and the Division of Plant Operations took over the operation in May 1960.

### TOTAL COST

The total cost of the project was \$382,773.39.

## **Project Staff**

Superintendent:	C. Fiddy
Senior Operator:	J. Jefferies
Operator:	F. Carmichael

### **COMMENTS**

The plant was normally supervised eight hours per day with the exception of the weekend, when only four hours per day of supervision was supplied.

L. Hordyk, Senior Operator, resigned on May 7, 1965 and was replaced by F. Carmichael. On Mr. Carmichael's request he was transferred back to an operator's position. J. Jefferies was then promoted to the Senior Operator's position on July 26, 1965.

The operator was transferred to the Drury Lane and Skyway plants during the year on a scheduled basis. Under this arrangement the operator developed and maintained familiarity with the three Burlington Water Pollution Control plants. The rotating schedule proved to be very successful.



PRIMARY CLARIFIER (FOREGROUND) AND AERATION TANK

## Description of Project

### INFLUENT WORKS

The sewage enters the plant's sewage pump wet well through a 33 inch diameter and a 24 inch diameter sewer. From there, the sewage is pumped to the influent works. It is first screened through a barminitor which traps, cuts and grinds the larger solids, from there the sewage passes to the air degritter which removes heavy solids and then through the parshall flume, where the flow is measured. It is possible to by-pass both the barminitor and the grit chamber.

In the air degritter the "grit", high density solids, is settled by keeping the velocity of the sewage at one foot per second using an air diffuser. This allows the heavy solids to settle while the lighter solids remain in suspension. The town forces dispose of the grit in the town dump.

### PRIMARY CLARIFIERS

The sewage flow is divided between two primary clarifiers. Approximately 50% of the suspended solids of the incoming

sewage settle to the bottom of the clarifiers. Each clarifier is equipped with a circular sludge collector, which moves the settled sludge to a hopper, located at the bottom of the clarifier. The sludge is then pumped to a digestion tank.

#### AERATION

Settled sewage from the primary clarifiers flows by gravity to two single pass aeration tanks. There it is mixed with activated sludge, which has been returned from the final clarifiers, and aerated. There are two single pass aeration tanks each 19 ft. 6 in. x 98 ft. x 12 ft. The detention time is six hours with 25% return sludge at design flow.

Air is supplied by two blowers each supplying 750 cu. ft. per min. at 8.5 psi, with 100% stand-by. The blowers are driven by 40 hp motors.

#### SLUDGE DIGESTION TANK

The Elizabeth Gardens plant operates one digester, 45 feet in diameter and 20 feet deep. Sludge is pumped from the primary clarifier to the digester. The roof is a fixed steel cover and the sludge is mixed by a single draft tube mixer. The sludge is heated through a hot water heat exchanger. Digested liquid sludge is hauled by tank truck.

#### FINAL CLARIFIERS

The aerated mixed liquor from the aeration section is retained in the single final clarifier for 2.2 hours at design flow. This allows the activated sludge to settle and it is collected in the bottom of the tanks and returned to the aeration section or wasted. (Excess activated sludge is wasted to the primary clarifiers, where it settles and is pumped to the digester). The remaining liquid flows over the weirs of the final clarifier and is chlorinated in the chlorine contact chamber before discharged as final effluent to Lake Ontario.



DIGESTER AND DIGESTION CONTROL BUILDING

## PROJECT COSTS

NET CAPITAL COST (Final)	
Long Term Debt to OWRC	<u>\$382,773.39</u>
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1965	<u>\$ 90,080.24</u>
Net Operating	\$ 21,966.58
Debt Retirement	13,887.00
Reserve	2,031.66
Interest Charged	<u>21,476.23</u>
TOTAL	<u>\$ 59,361.47</u>

### RESERVE ACCOUNT

Balance at January 1, 1965	\$ 10,043.23
Deposited by Municipality	2,031.66
Interest Earned	550.95
	<u>\$ 12,625.84</u>
Less Expenditures	(1,150.13)
	<u>\$ 11,475.71</u>

## MONTHLY OPERATING COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	* SUNDY	WATER
JAN	874.03	818.86					39.77			15.40	
FEB	1803.05	766.49		124.46	303.53	224.03	38.86		24.16	212.04	109.48
MARCH	1677.59	862.14		96.74	347.49		74.31		20.60	276.31	
APRIL	1830.74	877.00		131.74	367.69		46.17	98.82	1.48	209.76	98.08
MAY	2693.43	1631.49		99.12	280.96	224.03	67.28	26.77		363.78	
JUNE	2015.57	814.20			286.31		45.08	221.62	234.00	316.28	98.08
JULY	1445.65	804.67		99.96	260.17		70.21		75.89	134.75	
AUG	1750.58	874.42			259.58	224.03	53.83		1.50	239.14	98.08
SEPT	1425.12	964.88			250.07		17.50	16.38	11.42	164.87	
OCT	2018.08	1334.03		136.50	262.55		18.85		3.50	164.57	98.08
NOV	1929.48	943.11			259.58	224.03	54.10		294.11	154.55	
DEC	2503.26	1196.62		77.14	574.39	216.34	167.24		49.83	123.62	98.08
<b>TOTAL</b>	<b>21966.58</b>	<b>11887.91</b>		<b>765.66</b>	<b>3452.32</b>	<b>1112.46</b>	<b>693.20</b>	<b>363.59</b>	<b>716.49</b>	<b>2375.07</b>	<b>599.88</b>

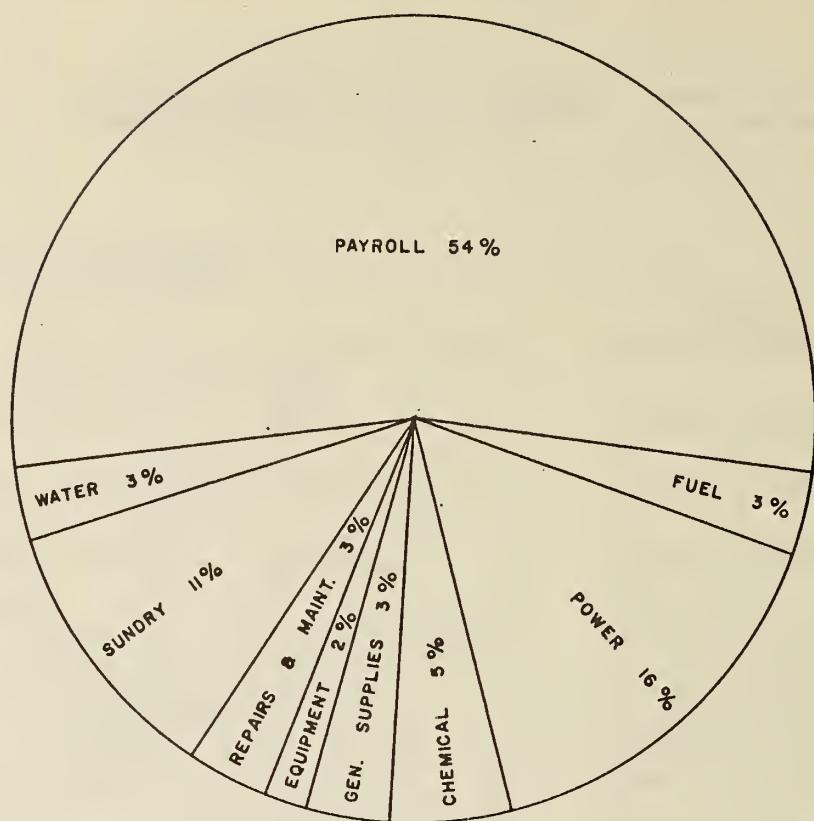
\* SUNDY INCLUDES SLUDGE HAULING COSTS WHICH WERE \$1,551.39  
 BRACKETS INDICATE CREDIT

## YEARLY OPERATING COSTS

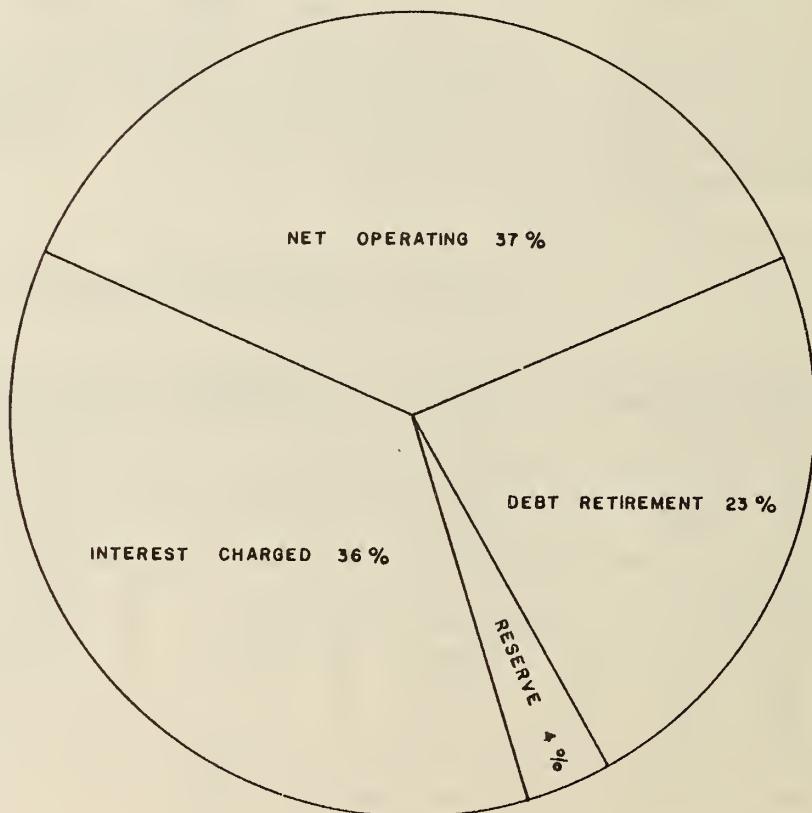
YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	172,733	\$ 23,541	*	\$ 136.25	4 CENTS
1962	156,921	21,800	-	139.00	4 CENTS
1963	221,120	26,010	-	120.50	4 CENTS
1964	235,486	21,958	7.78	93.24	6 CENTS
1965	299,865	21,966.58	7.92	73.25	6 CENTS

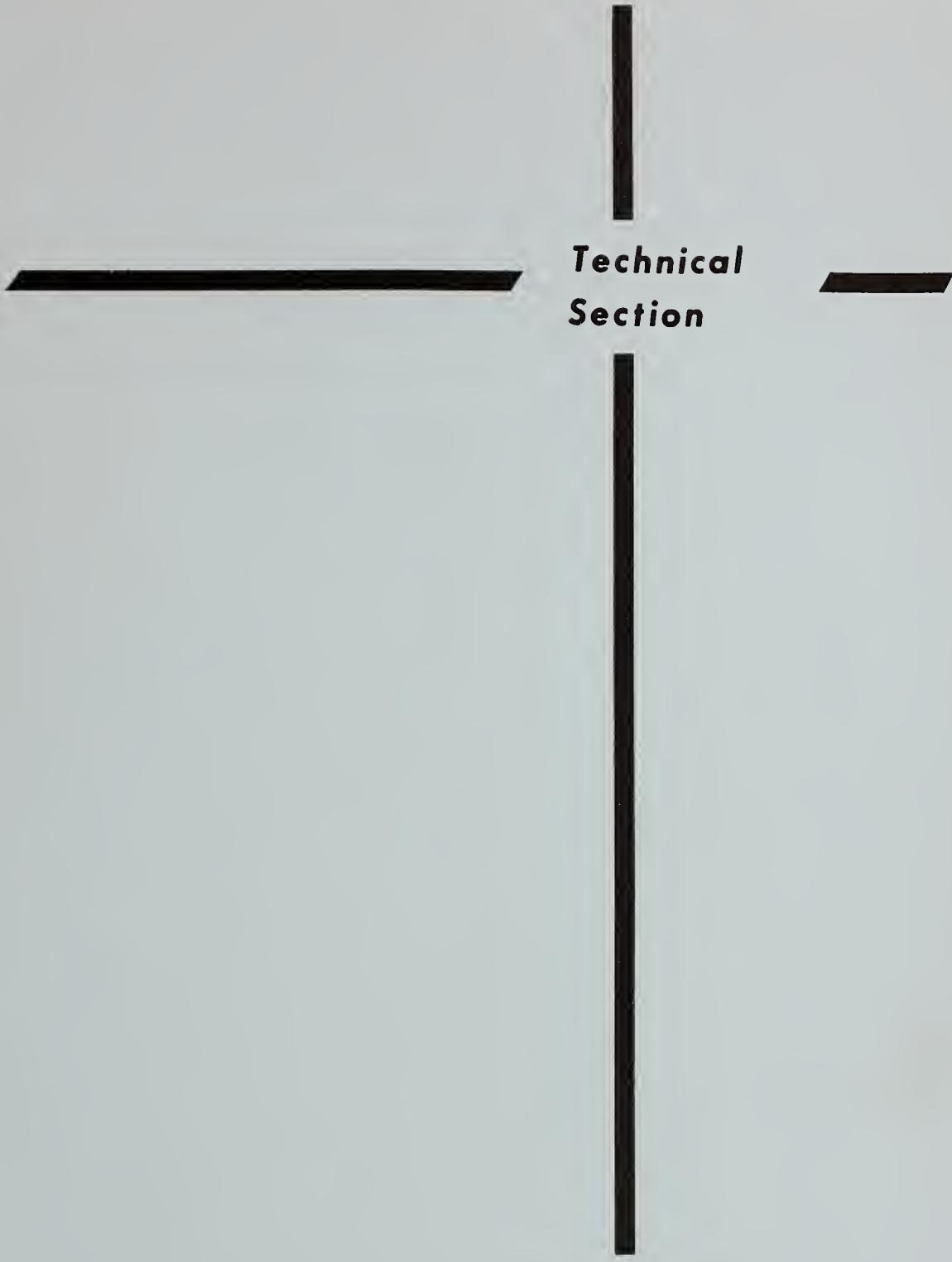
\* BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

## 1965 OPERATING COSTS



## TOTAL ANNUAL COST





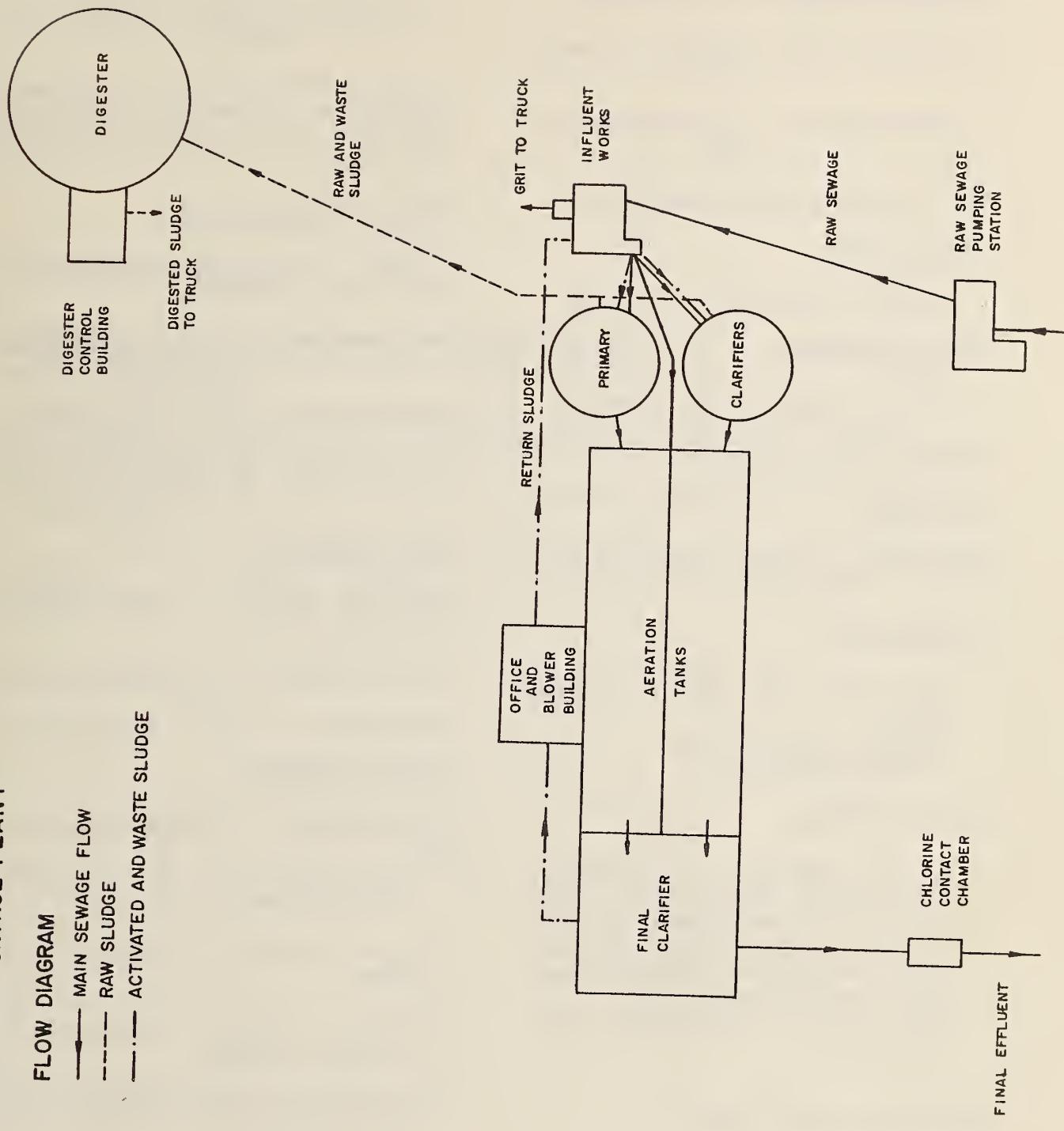
**Technical  
Section**



BURLINGTON ELIZABETH GARDENS  
WATER POLLUTION CONTROL PLANT

FLOW DIAGRAM

— MAIN SEWAGE FLOW  
- - - - - RAW SLUDGE  
- - - - - ACTIVATED AND WASTE SLUDGE



# Design-Data

## GENERAL

Type of Plant - Activated Sludge

Design Population - 7,500 persons

Per Capita Flow - 100 gallons per capita per day.

Design Plant Flow - 750,000 gallons per day.

Raw Sewage (for design purposes)

## Five Day BOD -

253 ppm. Est. Removal - 90-95%

## Suspended Solids -

280 ppm. Est. Removal - 95%

## PRIMARY TREATMENT

### Screening

Barminutor - Chicago Pump Company.  
Model B - Size 18

### Grit Removed

Air degritter 8' x 14' x 7' Average Depth.  
Retention Period 10 min.  
4 Colaflex Diffusers.

### Primary Settling

2 Dorr Clarifiers - one existing.  
New one 22 ft. diameter x 9 ft. SWD  
Central Feed - mechanically cleaned.  
Retention Period. (Total) 2 hours  
Surface Settling Rate - 980 gallons per square foot per tank per day.  
Overflow Rate - 5430 gallons per foot weir per day.

## SECONDARY TREATMENT

Aeration - 2 tanks - each 19 ft. 6 in. x 98 ft. x 12 ft. SWD.

Total Volume - 44,000 cu. ft.

<sup>14</sup> Retention Period - 6 hours with 25% return sludge.

Diffuser System - 60 in. "Colaflex" diffusers per tank - Compressors.

Air Supply - 1.2 cu. ft. per gallon + 100% Standby.

Aeration Tanks designed on loading of 25# BOD per 100 pounds of sludge solids and return on sludge to have a Mohlmen index of 250.

## FINAL SEDIMENTATION

2 Units - each 40 ft. x 40 ft. x 10 ft.  
SWD - Dorr Mechanism.

Retention Period - 2.2 hours including return sludge (Marginal) (5/4 Q)

Surface Settling Rate - 470 gallons per sq. ft. per day (on Q)

Overflow Rate - 4690 gallons per ft. weir per day (on Q)

## CHLORINATION

Maximum capacity of chlorinator 200 pounds per 24 hours.

Contact Chamber - to use existing chamber.

Contact time - 10 min + outfall sewer.

## SLUDGE DISPOSAL

Heated digester - 45 ft. diameter x 20 ft. SWD

- Walker gas oil unit rated at 250,000 BTU's per hour.

- Digester Capacity - 4.2 cu. ft. per capita

- Loading - 1.6 lbs. per solids per cu. ft. tank per month.

- Final disposal of liquid sludge by tank truck to farms.

Other Notes:-

Sludge return is by pumps with Chicago Pump splitter box.

Influent works for existing plant will not be changed.

## **Process Data**

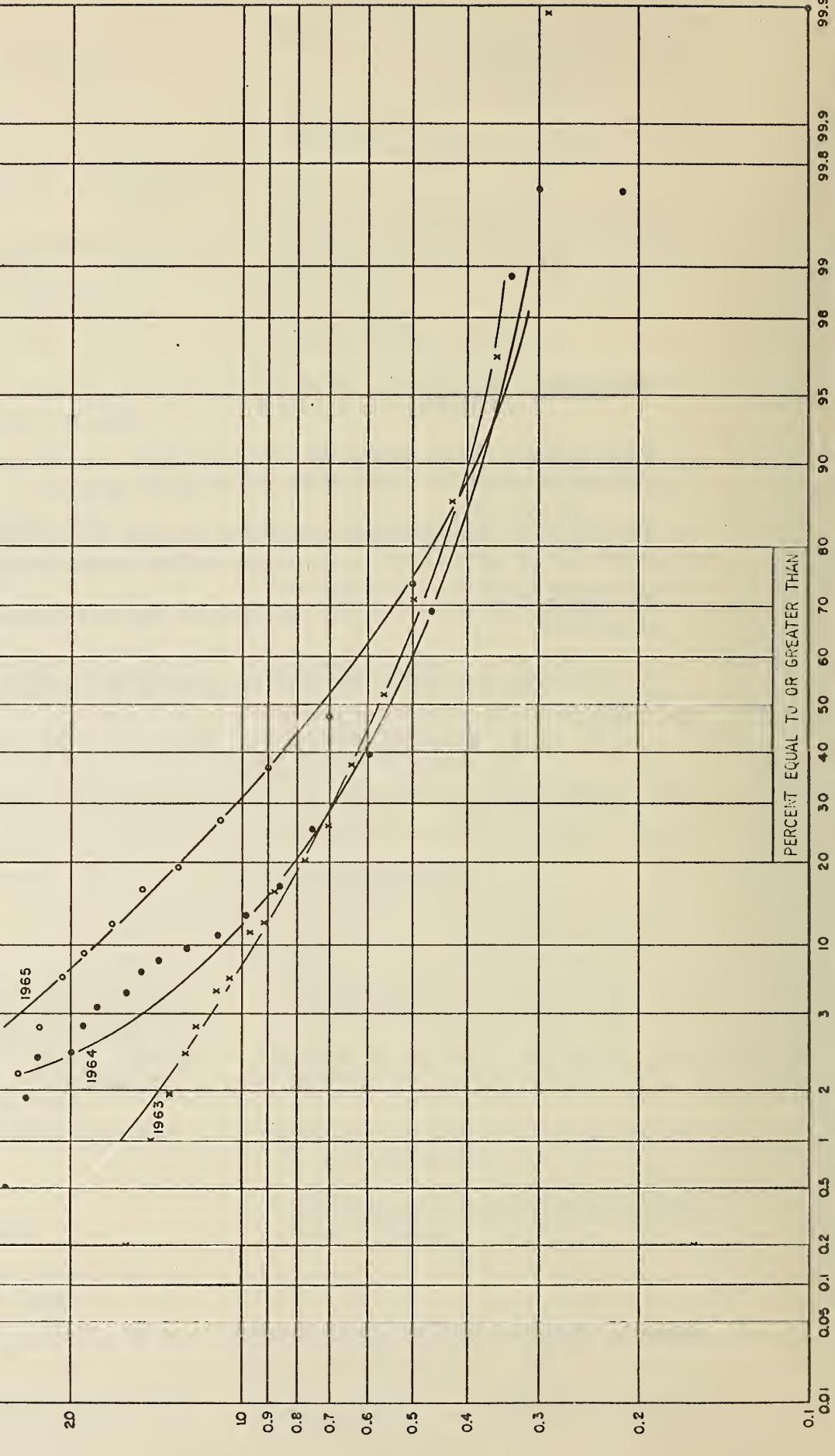
Average daily flows presented on a probability basis and on a monthly average basis can be found on the following two graphs.

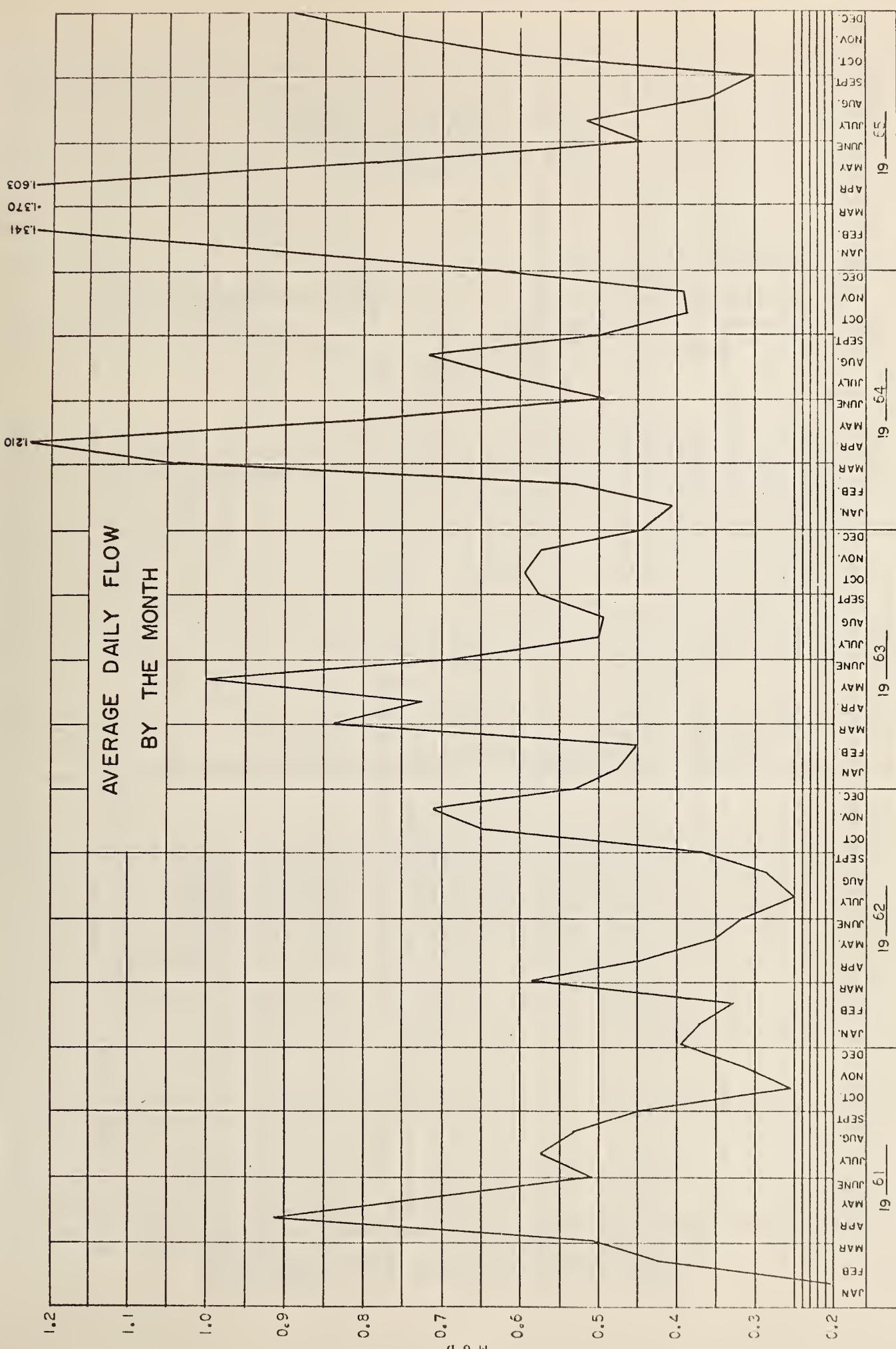
The maximum and minimum daily flows average on a monthly basis were 1.603 million gallons and 0.30 million gallons respectively.

The design flow of 0.75 million gallons per day was exceeded 48 percent of the time.

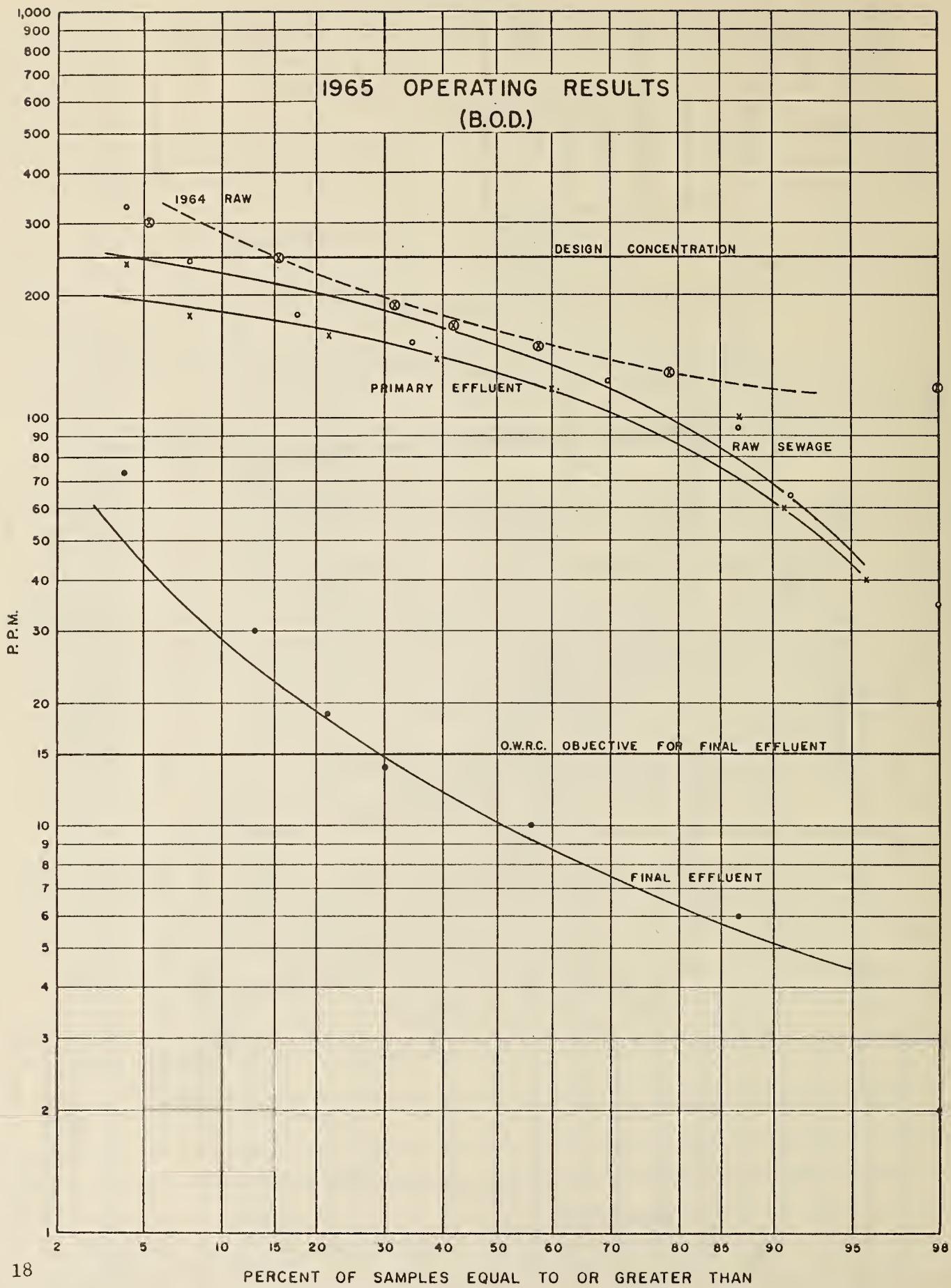
On an average throughout the year the daily flow was 0.822 million gallons.

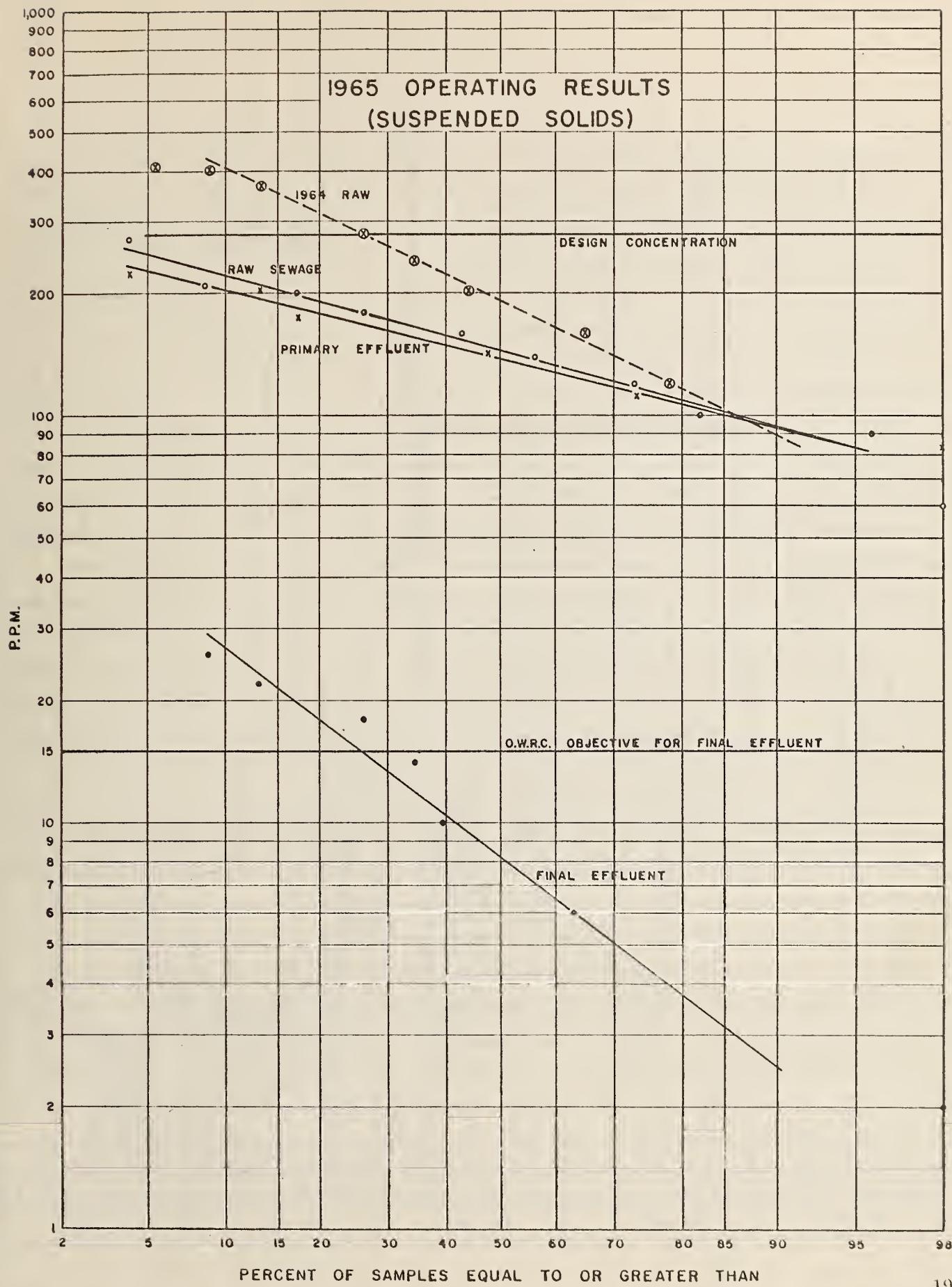
## PROBABILITY OF FLOWS

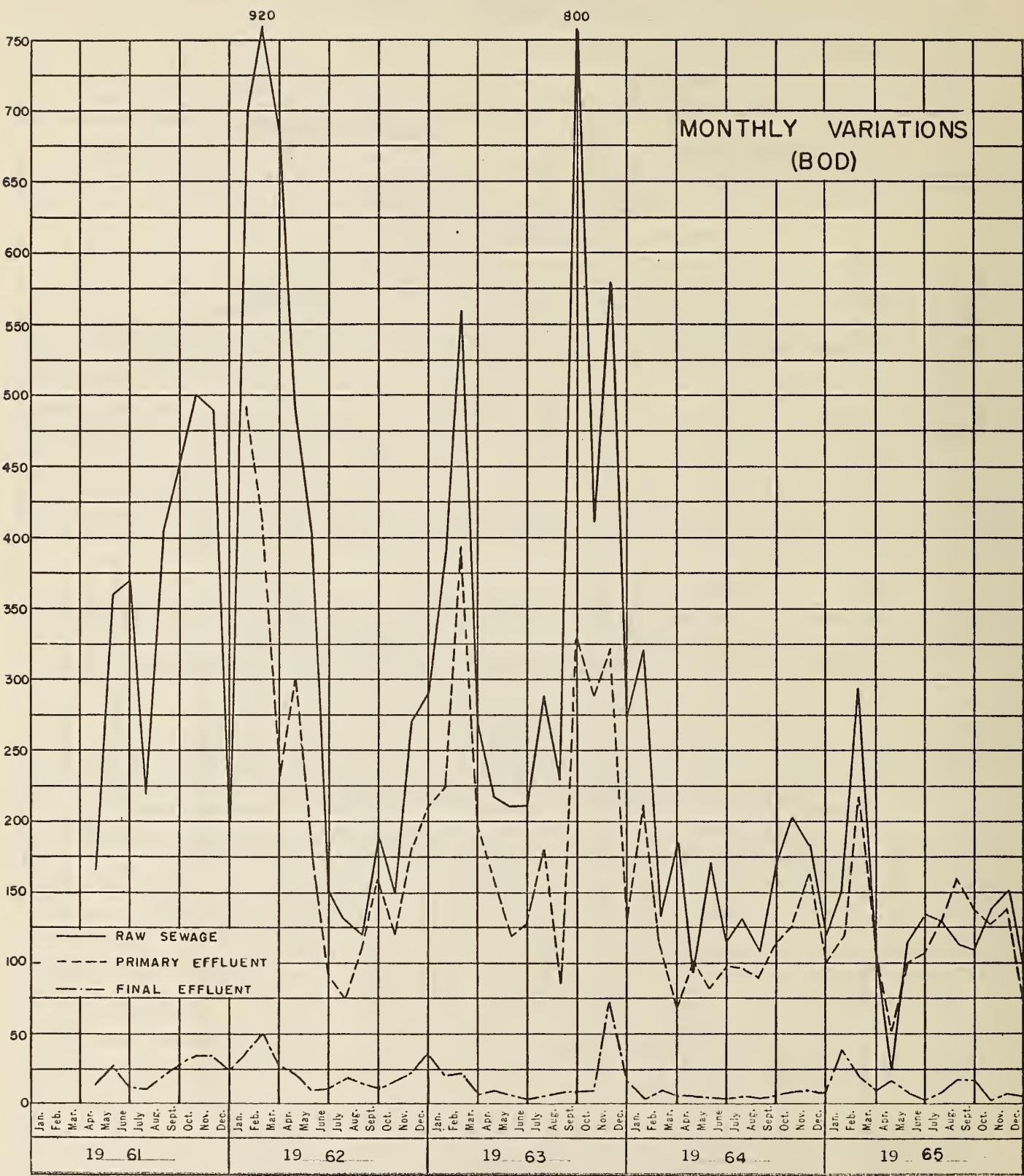


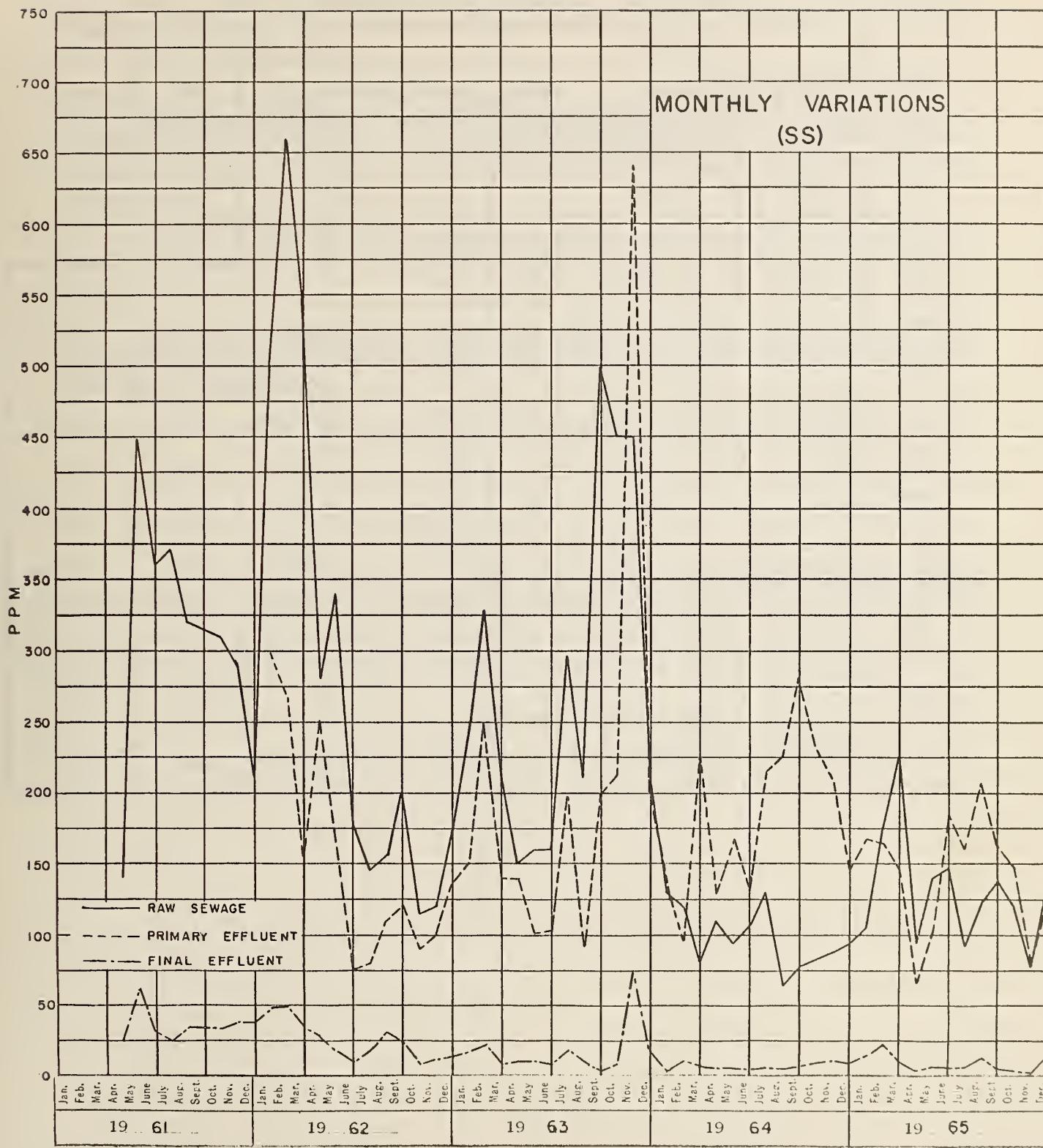


1965 OPERATING RESULTS  
(B.O.D.)









### GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT PPM.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	INFLUENT PPM.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	
JAN.	152	40	73.5	15.8	168	14	91.5	6.8	70
FEB.	295	20	93.0	51.6	165	22	86.5	26.8	60
MAR.	112	10	91.0	21.7	149	11	92.5	29.3	72
APR.	27	16	40.5	2.6	66	4	94.0	14.9	44
MAY	116	9	92.0	12.9	101	7	93.0	11.3	35
JUNE	135	2.8	98.0	8.9	188	5	97.5	12.3	13
JULY	130	9	93.0	9.7	162	6	96.0	12.6	22.5
AUG.	160	18	88.5	7.9	208	12	94.0	10.9	40
SEPT.	140	17	88.0	5.6	160	5	97.0	7.0	25
OCT.	128	3.7	97.0	11.8	149	4	97.5	13.7	90
NOV.	140	9.4	93.0	15.0	80	3	96.0	8.8	60
DEC.	73	6	91.5	9.3	126	16	87.5	15.3	81
<b>TOTAL</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>181.4</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>202.4</b>	<b>612.5</b>
<b>AVG.</b>	<b>134</b>	<b>13</b>	<b>90.0</b>	<b>15.1</b>	<b>144</b>	<b>9</b>	<b>93.5</b>	<b>16.9</b>	<b>51.0</b>

## COMMENTS

Raw sewage, primary effluent and final effluent BOD and suspended solids concentrations are presented on an average per month basis and on a probability basis on the four previous graphs.

The average raw sewage BOD and suspended solids concentrations during the year were 134 ppm and 144 ppm respectively. The average effluent BOD and suspended solids concentrations during the year were 13 ppm and 9 ppm respectively. On an average the BOD and suspended solids reductions were 90.0 percent and 93.5 percent respectively.

The design raw sewage BOD concentration of 253 ppm was exceeded 4 percent of the time. The design raw sewage suspended solids concentration of 280 ppm was not exceeded.

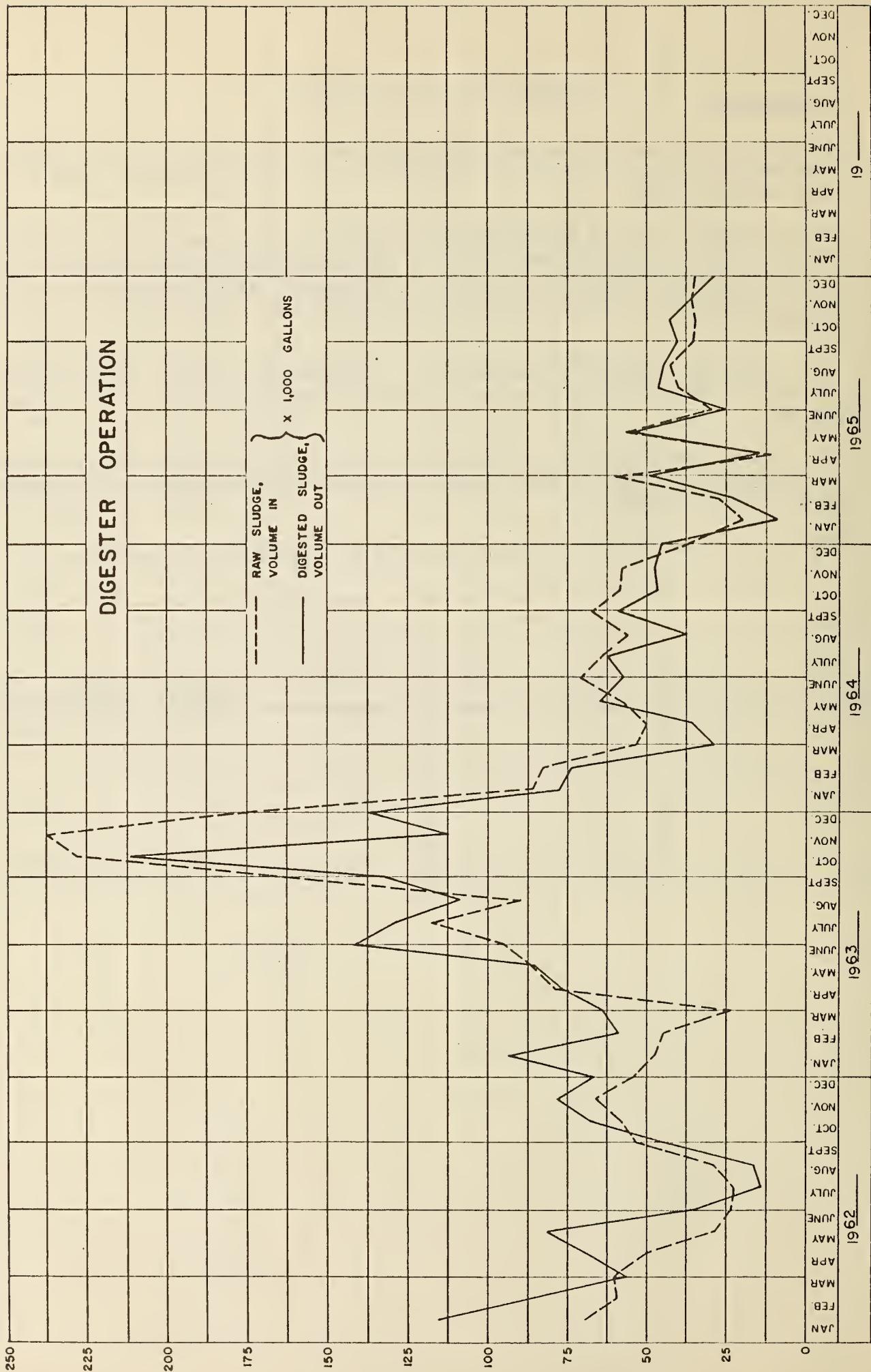
The Ontario Water Resources Commission's objective of not more than 15 ppm of BOD or suspended solids concentration in the final effluent was exceeded 29 and 26 percent of the time respectively.

During the year a total of approximately 613 cubic feet of grit were removed.

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ANNUAL REPORT 1965

## DIGESTER OPERATION

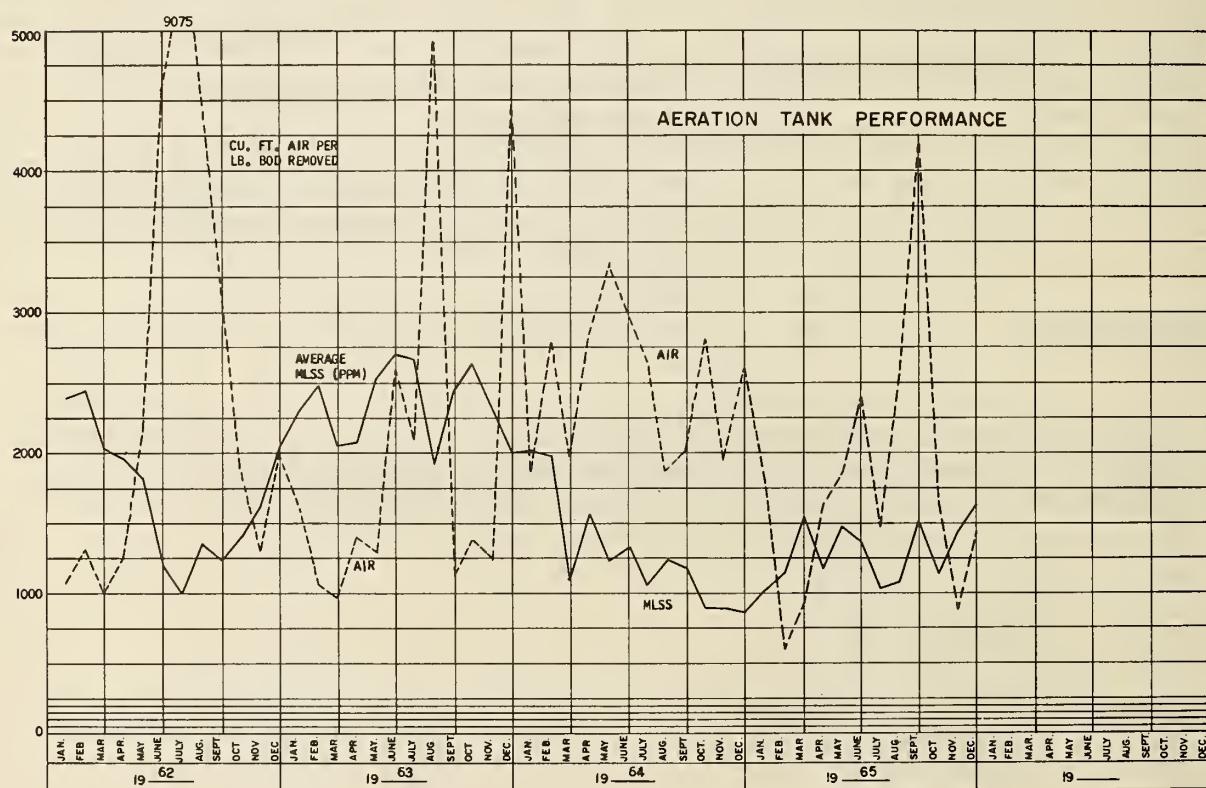
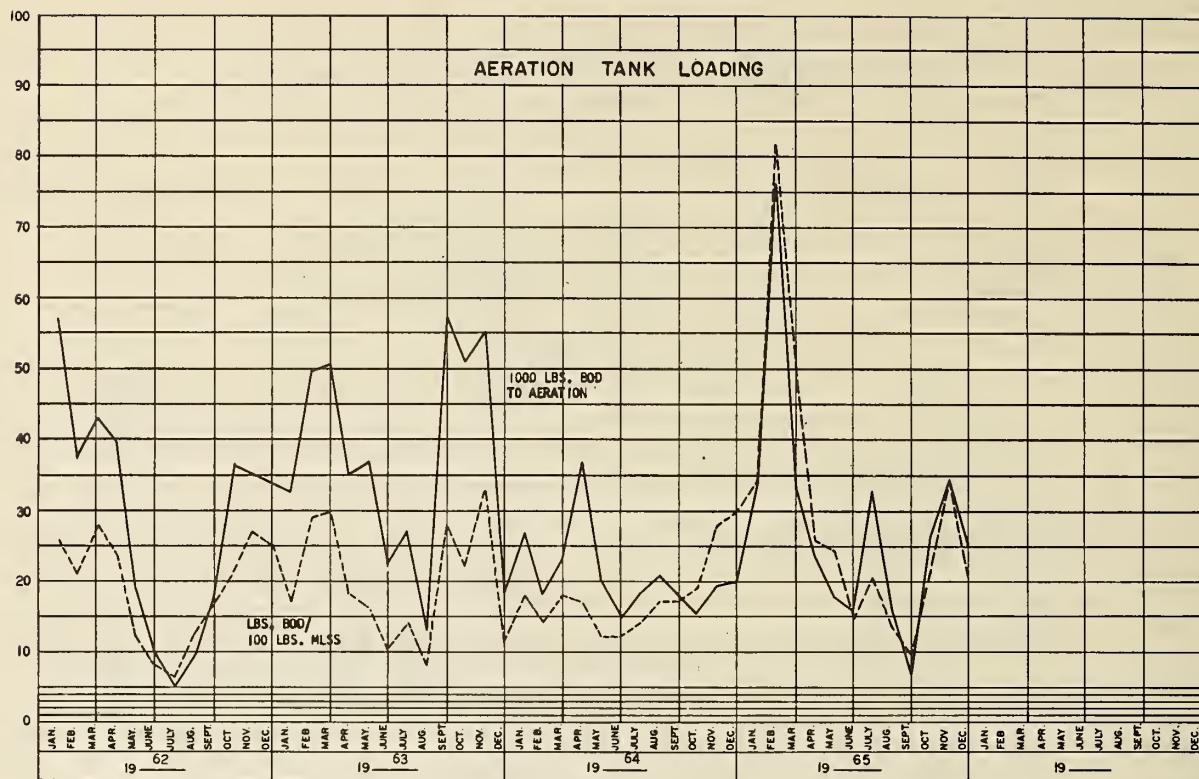


## DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu Ft.
	1000'S CU FT	% SOLIDS	% VOL. MAT	1000'S CU. FT.	% SOLIDS	% VOL. MAT	
JAN	3.27	-	-	1.46	-	-	-
FEB.	4.42	-	-	3.84	-	-	-
MAR.	9.74	-	-	7.90	-	-	-
APR.	1.92	-	-	2.43	-	-	-
MAY	9.04	4.25	3.18	9.02	-	-	-
JUNE	4.74	-	-	4.04	2.40	1.42	-
JULY	6.44	3.64	1.48	7.45	4.20	1.97	-
AUG.	6.88	6.60	4.75	7.14	2.40	1.27	-
SEPT.	5.85	-	-	6.52	-	-	-
OCT.	5.72	4.20	2.86	6.83	3.80	1.82	-
NOV.	5.86	-	-	-	-	-	-
DEC.	5.62	-	-	4.66	-	-	-
TOTAL	69.50	-	-	61.29	-	-	-
AVG.	5.79	4.67	3.07	5.11	3.07	1.62	-

### COMMENTS

Sludge volumes per month to and from the digester are plotted on the accompanying graph. On an average the volatile solids were reduced by 41.6 percent which indicates that the digester operated efficiently throughout the year.



## AERATION SECTION

MONTH	PRIM. EFL B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. BOD. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY	119	1044	34	1839
FEBRUARY	218	1145	76	597
MARCH	118	1556	34	915
APRIL	54	1389	24	1634
MAY	101	1485	18	1851
JUNE	108	1354	16	2411
JULY	130	1074	33	1496
AUGUST	123	1148	16	2602
SEPTEMBER	110	1504	7	4337
OCTOBER	140	1140	22	1631
NOVEMBER	150	1440	34	866
DECEMBER	90	1625	12	2069
TOTAL	-	-	-	-
AVERAGE	122	1326	27	1854

### COMMENTS

Average daily pounds of BOD to the aeration section and pounds of BOD per 100 pounds of mixed liquor suspended solids, both averaged on a monthly basis are plotted at left. On the same page cubic feet of air per pounds of BOD removed and the daily average mixed liquor suspended solids concentrations are plotted, both also averaged on a monthly basis.

The average pounds of BOD per 100 pounds of mixed liquor suspended solids was 27 which is acceptable for normal operation. The average cubic feet of air per pound of BOD removed was 1854 which is slightly greater than the maximum recommended value of 1500. The average BOD in the primary effluent was 122 ppm and the average mixed liquor suspended solids concentration in the aeration section was 1326 ppm.

## CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	28.287	626	2.21
FEBRUARY	37.539	611	1.63
MARCH	42.482	629	1.48
APRIL	48.078	601	1.25
MAY	24.094	528	2.19
JUNE	13.434	408	3.04
JULY	16.102	532	3.30
AUGUST	11.142	527	4.73
SEPTEMBER	9.088	408	4.49
OCTOBER	18.915	584	3.09
NOVEMBER	22.924	681	2.97
DECEMBER	27.780	640	2.30
TOTAL	299.865	6775	-
AVERAGE	24.989	565	2.26

### COMMENTS

Throughout the year a minimum chlorine residual of 0.5 ppm was maintained with an average dosage rate of 2.26 ppm.

## CONCLUSIONS

The average BOD and suspended solids removals were 90.0 percent and 93.5 percent during periods when the flow was not by-passing the aeration section. The average daily flow was 0.822 million gallons which is 8.9 percent greater than the design flow. Throughout the year the plant staff operated a clean, attractive and efficient plant for the Town of Burlington.

## RECOMMENDATIONS

The storm flows received at the plant were in excess of the design flow quite often. This suggests a serious infiltration problem. It is therefore recommended that the Town of Burlington take the necessary steps to have an infiltration study of the sanitary sewers conducted. The correction of the infiltration problem would reduce the hydraulic load at the plant during storm periods and consequently prevent primary effluent and untreated sewage from reaching Lake Ontario.

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